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ADDITIONAL REVISIONS TO THE K-65 RESIDUE SAMPLING AND ANALYSIS PLAN

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JUN 13 1991
DOE-1511-91

Ms. Catherine A. McCord
Remedial Project Manager
U. S. Environmental Protection Agency
Region V - 5HR-12
230 South Dearborn Street
Chicago, IL 60604

Mr. Graham E. Mitchell, DOE Coordinator
Ohio Environmental Protection Agency
40 South Main Street
Dayton, OH 45402

Dear Ms. McCord and Mr. Mitchell:

ADDITIONAL REVISIONS TO THE K-65 RESIDUE SAMPLING AND ANALYSIS PLAN

A subsequent review of the revised Residue Sampling and Analysis Plan, as submitted to you on May 29, 1991, has resulted in additional modifications to the plan. The revised pages are enclosed for your incorporation into the plan.

If you have any questions or comments, please contact Randi Allen at FTS 774-6158 or (513) 738-6158. We apologize for any inconvenience this may have caused in your review of the package.

Sincerely,

Jack R. Craig
Fernald Remedial Action
Project Manager

FSO:Allen

Enclosure: As stated

cc w/encl.:

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original design thickness of 4 inches at the center and this thickness tapered to 8 inches at the dome wall edge.

Radionuclide Analysis:

Historic analyses of the K-65 silo residues indicated that approximately 11,200 kilograms of uranium (0.71 percent U-235) is present in the residues (Grumski 1987; ASI/IT 1988). Analytical results of residue samples taken in July 1988 (Gill 1988) indicated that the uranium concentration was 1400 parts per million (ppm) in Silo 1 and 1800 ppm in Silo 2. In addition, approximately 1.6 to 3.7 kilograms of radium were estimated to be in the K-65 Silo residues (Grumski 1987; Litz 1974). Data from these previous studies are summarized in Tables 1-1 and 1-2.

Radiological data from the 1989 sampling effort for Silos 1 and 2 are presented in Table 1-3. The concentration of Ra-226 in Silo 1 ranges from 89,280 pCi/g to 192,600 pCi/g; in Silo 2 it ranges from 657 to 145,300 pCi/g. Th-230 concentrations in Silo 1 range from 10,569 to 43,771 pCi/g; 8365 to 40,124 pCi/g in Silo 2. The concentrations of Pb-210 in Silo 1 range from 48,980 to 181,100 pCi/g; and they range from 77,940 to 399,200 pCi/g in Silo 2. Total uranium concentrations in Silo 1 range from 1189 to 2753 ppm and they range from 137 to 3717 ppm in Silo 2.

Chemical Analysis

Chemically, the K-65 residue material within Silo 1 and 2 are mixtures of hydroxides, carbonates, and sulfates. Approximately 40 to 60 percent of the residue material is silicates (SiO_2); carbonates and sulfates comprise approximately 20 percent. The primary form of uranium contained in the residue material is sodium uranyl carbonate (Dettorre et al., 1981). Other elements contributing at least 1 percent to the total are calcium, iron, magnesium, and lead. Table 1-2 presents a summary of the elemental, nonradioactive constituents of the silos.

Samples obtained during the 1989 sampling effort were analyzed for HSL inorganics and organics. A summary of the analytical data for inorganic and organic constituents is provided in Tables 1-4 and 1-5. Complete analytical results are provided in Appendix B of the OU 4 RI Report. The results of the HSL inorganic analyses show that the principal inorganic constituents in Silos 1 and 2 are barium, calcium, iron, lead and magnesium. PCBs (Aroclor 1248 and 1254) were detected in samples collected from the K-65 silos with concentrations ranging from 1700 to 12,000 parts per billion (ppb) and 1900 to 3900 ppb, respectively.

Geotechnical Analysis

Silos 1 and 2 contain waste raffinate slurries that were decanted by means of baffles and weirs placed along the height of the silo wall. Over the years the waste slurries have settled to form a wet muddy-looking material that is a mixture of clay and silty sand

2.2 Recommended Number of Samples

The spatial variability of the silo contents must consider both horizontal and vertical variability. The known disposal history would indicate that the K-65 residues are homogenous in the horizontal direction and non-homogeneous in the vertical direction. Material variability in the vertical direction is most directly related to changes in the disposed material over time.

An underlying assumption in the statistical analysis to determine sample size is that the expected mean concentration of each parameter is equal to 50 percent of the RT. Based on the assumption that the RT is twice the mean concentration, the recommended number of samples per SW-846 would increase as the mean concentration approaches the RT and decrease as the mean concentration moves away from the RT. Probability dictates that any RT is more likely to fall outside of the narrow range between the observed mean and the RT. Consequently, the difference between the actual mean and the RT will be much greater than the value used in the current calculations, resulting in a lower number of samples to be collected than estimated here.

Tables 2-1, 2-2, and 2-3 summarize the results of the analyses of the number of samples to be collected using the 1989 data and SW-846 methodology. In all cases except three, the recommended number of samples is less than four. The exceptions involve arsenic, calcium, and copper in Silo 2. The large number for arsenic is primarily due to the one high reading (1960) in sample S2NE1. Calcium concentrations span three orders of magnitude; however, because this parameter is not likely to drive the remedial effort, there seems little reason to use the recommended number of samples calculated for this parameter as the minimum number that should be collected for all parameters. The higher than average number of samples for copper is attributed to two factors: a high reading in S2NE1 (1790) and the substitution of the value zero for the ND reading in sample S2NE2. A more appropriate value to use would have been one-half the detection limit. Use of this value would have resulted in a lower number of recommended samples.

It has been determined, that the most successful technique for recovering the silo material is to segregate each complete sample core into one-third sampling attempts. This may cause an additional time delay of up to two weeks per sample core per manway at up to three times the additional time and materials cost. Based on this knowledge and the minimum requirements for the SW-846 statistical analysis, three sample cores shall be drawn from each silo for analysis and archiving. Eight samples will be drawn from two cores from each silo for a total of 18 samples. Figures 2-1, and 2-2 show the core sectioning and sampling scheme for the sampling program.

TABLE 2-4
CORE SECTIONS AND ANALYSES (RADIOLOGICAL AND CHEMICAL)

SAMPLE NO.	CORE SECTION SAMPLED	ANALYSIS REQUESTED
1	2S1-SE-A- 1. 2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
2	2S1-SE-B-1,2,3,4, & 5	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
3	2S1-SE-C- 1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
4	2S1-SE-R	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
5	2S1-NW-A- 1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
6	2S1-NW-B- 1,2,3,4,	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
7	2S1-NW-C-1,2,3,4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
8	S21-NW-D	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
9	2S1-NW-R	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
10	2S1-NE-A-1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
11	2S1-NE-B-1,2,3,4, & 5	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
12	2S1-NE-C-1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
13	2S1-NE-R	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
14	2S2-SE-A-1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
15	2S2-SE-B-1,2.3, 4 & 5	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
16	2S2-SE-C-1,2,3 & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
17	2S2-SE-R	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
18	2S2-NW-A-1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
19	2S2-NW-B-1,2,3,4,5	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
20	2S2-NW-C-1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
21	2S2-NW-D	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
22	2S2-NW-R	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL

TABLE 2-4
CORE SECTIONS AND ANALYSES (RADIOLOGICAL AND CHEMICAL) (Continued)

23	2S2-NE-A-1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
24	2S2-NE-B-1,2,3,4, & 5	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
25	2S2-NE-C-1,2,3, & 4	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL
26	2S2-NE-R	HSL ORGANICS, HSL INORGANICS, TCLP ORGANICS, TCLP METALS, PCBs, PESTICIDES, RADIOLOGICAL

CORE SECTIONS AND ANALYSES (GEOTECHNICAL)

27	2S1-SE-A-1 THRU 4 2S1-NW-A-1 THRU 4	SEE TABLE 3-3
28	2S1-SE-B-1 THRU 5 2S1-NW-B-1 THRU 5	SEE TABLE 3-3
29	2S1-SE-C-1 THRU 4 2S1-NW-C-1 THRU 4	SEE TABLE 3-3
30	2S2-SE-A-1 THRU 4 2S2-NW-A-1 THRU 4	SEE TABLE 3-3
31	2S2-SE-B-1 THRU 5 2S2-NW-B-1 THRU 5	SEE TABLE 3-3
32	2S2-SE-C-1 THRU 4 2S2-NW-C-1 THRU 4	SEE TABLE 3-3

for analytical sampling must be decontaminated prior to use by an Alconox wash, deionized water rinse, methanol rinse, O.1N hydrochloric acid rinse followed by a final deionized water rinse. Two equipment rinsate samples must be done with deionized water poured over the equipment used for the 20th and 22nd samples. A blank of the deionized water must also be submitted for analysis.

Sampling equipment that is to be reused will be decontaminated before use for resampling. All non-analytical sampling equipment will decontaminated using a approved cleaner and rinsed with deionized water. All analytical sampling equipment will be decontaminated using an Alconox wash, deionized water rinse, methanol rinse, O.1N hydrochloric acid rinse, and deionized water rinse. Upon completion an equipment rinsate sample must be taken and submitted for analysis.

The sampling personnel will be responsible for decontaminating the equipment. Clean rubber gloves will be used for the decontamination activities. The RST will survey the equipment before and after cleaning to determine if the radiological contaminants have been removed. The procedures will be repeated a maximum of three times if necessary. If, after the third attempt, the equipment is not cleaned below the levels defined in Table 3-1, another piece of equipment will be used.

Gross decontamination conducted during silo sampling will be performed with an approved cleaner, followed by a wipe down with paper towels. Gross decontamination conducted in the sample trailer (outside of lexan tube) will be done with the use of damp paper towels.

All equipment to be decontaminated will be handled in an area designated for this purpose. Catch basins will be used to collect excess decontamination solutions. These solutions will be transferred to properly labeled 55 gallon drums. All paper towels, gloves, catch basins, shoe covers, protective clothing, etc. shall be disposed of as referenced in Section 7.

3.6 Sampling Packaging and Shipping

Shipment of samples off-site will be done in accordance with WMCO Procedures. Samples for shipment will be packaged using package type 37A or 39, depending on hazard class determined by the preliminary screening. Overpacks will be used as much as possible to consolidate packages for shipment of samples with compatible hazard classifications.

Department of Transportation (DOT) labeling for packages will comply with the requirements of 49 CFR, parts 170-179. The labeling class requirements will be determined by the hazard class assigned to the samples during screening. All samples will be transported by a licensed, sole-usage contractor to ensure prompt delivery of samples and to provide a tracking mechanism for undelivered sample shipments. All paperwork to accompany each sample will be inserted into a Ziplock plastic bag to be enclosed with the sample.

3.7 Sample Analyses

The K-65 samples will be analyzed for physical, chemical, and radiological parameters as described in the following subsections. The proposed number of samples to be selected for each type of analysis was presented in Section 2.2.

3.7.1 Radiological and Chemical Analyses

Selected K-65 samples will be analyzed for radiological and chemical constituents to characterize the materials for the evaluation of disposal options. Isotopes of non-positive hits for radionuclides shall have their detection limits reported. The required radiological analyses are listed below:

- Isotopic uranium
- Isotopic thorium
- Isotopic radium
- Pb-210
- Gamma spectroscopy
- Total uranium
- Polonium-210
- Protactinium-231
- Actinium-227

All samples will also be analyzed for the following chemical parameters:

- TAL inorganics (See Table 3-2 for list of metals)
- HSL Volatiles
- HSL Semivolatiles and Tributylphosphate
- HSL Pesticides and PCBs (if positive hits, confirm by GC/MS)
- TCLP Metals

Samples found to contain organic compounds based on HSL organic analysis will be analyzed for organics by TCLP analysis. Additional chemical characterization analysis include:

- Total Phosphorous
- Total Organic Carbon
- Ammonia
- Total Kjeldahl Nitrogen
- Total Organic Nitrogen
- Oil and Grease
- Soil pH
- Bromide (By Ion Chromatography)
- Chloride (By Ion Chromatography)
- Nitrate (By Ion Chromatography)
- Sulfate (By Ion Chromatography)

Chemical analyses will be conducted using EPA Contract Laboratory Program (CLP) protocols when possible. CLP protocols will be modified only when conflicts arise between procedures established for handling radioactive materials and nonradioactive CLP procedures.

Table 3-2

INORGANIC TARGET ANALYTE LIST (TAL)

Analyte	Analyte
Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Molybdenum
Beryllium	Nickel
Boron	Potassium
Cadmium	Selenium
Calcium	Silicon
Chromium	Silver
Cobalt	Sodium
Copper	Thallium
Cyanide	Vanadium
Iron	Zinc
Lead	

4.0 K-65 SILOS STRUCTURAL INTEGRITY

Due to environmental elements, the K-65 silo domes have deteriorated and are considered the weakest structural components of the silos. The placement of dome covers over the structurally deficient 20-foot center portion of the domes was considered only as a temporary remedial solution (1 to 2 years). Since final remediation plans for the K-65 silos will take at least 3 years to develop and implement, additional remedial actions to provide for continued safe containment of the K-65 residues are being undertaken.

The continuing concern regarding the structural integrity of the silo domes was instrumental in the development of the operational procedures for the K-65 Sampling Program. The use of cranes located away from the silos was dictated by the constraint prohibiting placement of heavy equipment on the domes. The specified size of the crane was based on the need to maintain a factor of safety in relation to the momentum created by the weight of the sampling unit and the resistance forces during the sample withdrawal. This will minimize the risk of the crane overturning or failure of the cantilevered beam. A repositioning of the crane for each set of samples will keep the length of the arm at a minimum.

The probability of cable failure (resulting in a possible impact force on the dome by the falling sampling apparatus) is low considering the high tensile strength of the cable. Any significant resistance will be overridden by the start-up of the vibratory action of the Vibra-Corer, or by moving the boom to correct any angle in the load line.

Any loads that are on the domes during sampling will be kept at an acceptable level. The maximum number of sampling personnel on the dome at any given time will be limited to three individuals. The maximum weight limit for personnel and equipment on the silo domes is 700 pounds (Letter from R.B. Barber, Bechtel National to J.B. Craig, DOE). Recent silo sampling operations have shown that such loads can be supported. As an additional safeguard, no personnel or other loading will be allowed within the 20-foot central portion of the dome occupied by the plywood and steel cap. This portion is considered the most susceptible to structural failure due to the reduced thickness of the concrete in this area. It is also noteworthy that the snow load assumed under the worst-case structural analysis will not be of concern during the sampling program, thereby providing an additional factor of safety in the allowable loadings. As an additional safety precaution, safety nets will be installed in the immediate walking vicinity of the silo manways to minimize personnel injury in the event of a partial silo breakthrough.

05/09/91

FIGURE 8-1

K-65 RESAMPLING PROJECT

Activity	Orginal Schedule	Actual	Current Forcast
Mobilization	02/26/90	02/26/90	
Purchase Vibra Corer	02/09/90	03/05/90	
Vibra Corer Available	03/05/90	05/01/90	
Start Equipment Checkout	03/12/90	07/24/90	07/23/90
Mock Silo Sampling	03/26/90	08/13/90	08/13/90
Procedure Modification	09/10/90	09/27/90	09/27/90
Silo Net Mock-up	09/17/90	10/08/90	10/05/90
Start Silo Sampling S1-SW1	04/09/90	10/16/90	10/08/90
Start Silo Sampling S1-SW2		10/25/90	10/25/90
Sample Man-way #2 S2-SW1	04/16/90	11/07/90	11/05/90
Sample Man-way #2 S2-SW2	04/16/90	11/20/90	11/15/90
Sample Man-way #2 S2-SW3	04/16/90	11/27/90	11/27/90
Sample Man-way #3 S2-NE1	04/23/90	12/06/90	11/30/90
Sample Man-way #4 S2-SE"A"	04/30/90	12/11/90	12/03/90
Sample Man-way #4 S2-SE"B"	04/30/90	12/14/90	12/14/90
Start Berm Sampling	10/22/90	05/03/91	04/30/91
Complete Berm Sampling	01/31/91		06/07/91
Sample Man-way #4 S2-SE"C"	12/18/90		07/11/91
Sample Man-way S2-NW"A"			07/15/91
Sample Man-way S2-NW"B"			07/18/91
Sample Man-way S2-NW"C"			07/21/91
Sample Man-way S2-NE"A"	05/07/90		07/24/91
Sample Man-way S2-NE"B"	05/07/90		07/27/91
Sample Man-way S2-NE"C"	05/07/90		07/30/91
Sample Man-way S1-NW"A"	05/21/90		08/02/91
Sample Man-way S1-NW"B"	05/21/90		08/05/91
Sample Man-way S1-NW"C"	05/21/90		08/08/91
Sample Man-way S1-SE"A"	05/14/90		08/11/91
Sample Man-way S1-SE"B"	05/14/90		08/14/91
Sample Man-way S1-SE"C"	05/14/90		08/17/91
Sample Man-way S1-NE"A"			08/20/91
Sample Man-way S1-NE"B"			08/23/91
Sample Man-way S1-NE"C"			08/26/91
Start Demobilization	06/04/90		09/02/91
Egress Site	07/13/90		10/04/91

7.4.14.7 The crust retrieval device, with crust material inside, will be lifted into the manway glovebag.

7.4.14.8 An RST shall take radiation dose rate readings and cap the open end of the crust retrieval device.

7.4.14.9 Remove crust retrieval device using the pass through sleeve.

7.4.15 Operations personnel on the dome shall instruct the crane operator to lower the Vibra Corer until it is a few inches from the material surface.

7.4.16 Operations personnel shall guide the sampling barrel so that it is directly over the same hole it had been removed from previously.

7.4.17 The crane operator shall be instructed to slowly lower the Vibra Corer until it has reached the same depth that it had stopped at before.

7.4.18 The vibrating mechanism of the Vibra Corer shall be engaged again by the operations technician on the berm.

7.4.19 After the vibrating mechanism has been activated, the crane operator will be instructed to slowly lower the sampling barrel to a designated depth or 33 feet, to complete the last third (sample) of the boring.

7.4.19.1 Foot markings shall be read at the manway flange opening.

7.4.20 When the designated depth has been reached, the Supervisor will instruct the throttle operator to stop the vibrating mechanism. The IT Supervisor shall document the depth of the Vibra-corer in the project log.

7.4.21 Operations technicians shall disconnect the air vent tube near the Vibra Corer head.

7.4.22 With the concurrence of the IT Supervisor, the rigger shall signal the crane operator to start removal of the sampling device and the raising of the power supply from the silo. As the sampling device is withdrawn from the manway, a radiation survey shall be performed by the RST on the sampling device. If gamma radiation levels exceed 200 mr/hr, notify the IT supervisor to evaluate additional ALARA considerations.